INTERACTIONS OF CATIONIC FORMULATIONS ON HUMAN HAIR: EFFECTS ON CUTICLE TEXTURE AND CORTEX POROSITY

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During the daily care as cleansing, bleaching, ironing and others the hair fiber becomes damaged due to alterations in superficial charges, cuticle breakage and the protein loss from cuticle and cortex (1,2). Cationic formulations are used to treat damaged hair fiber. Cuticle and cortex properties change by the adsorption and diffusion of formulation ingredients (1,2).

The adsorption of cationic surfactants containing quaternary ammonium on hair surface has been majority attributed to electrostatic interactions between the negatively charged cuticle after shampooing and the positive charge of these compounds (1). The uniformity of the adsorbed layer has direct influence on damaged hair texture (3,4). Recent advances in computational image analyses and very low angle illumination on light microscope allow us to develop a new approach of hair texture evaluation (5). On the other hand, the diffusion of ingredients into cortex has been attributed mainly to size, concentration and affinity between the molecule and hair. Cationic surfactants play an important role in the diffusion process due to the deposition and charge-charge interactions on hair surface (1).

The aim of this study was to obtain quantitative data on hair cuticle texture and hair cortex porosity for healthy and damaged hair. The images of surface hair (texture) obtained by light microscope were categorized using by (GTSDM) grey-tone spatial dependence matrices. Bleached hair samples were treated with different conditioning formulations applied as leave on and rinse off processes. After bleaching treatment, the hair texture is significantly different from the control healthy hair. When a cationic formulation and rinsing off process were used, the bleached hair texture improvement by lowering energy beyond the measured to control healthy hair. Cationic formulation using leave on process does not allow the same results, however still improves the texture condition of bleached hair.

The quantitative data and images from cortex porosity were analyzed using X-ray micro–computed tomography (micro-CT) that is a fast-growing method in scientific research applications that allows the obtaining of non-destructive imaging of morphological structures (6,7). The influence of cationic compounds on cortex porosity after treatments was observed. We used two types of leave on formulation on bleached hair, the first formula containing cationic ingredients and the second formula without cationic. The formulation without cationic showed a significant reduction of cortex porosity, about 70% compared to the bleached hair only. Meanwhile another formulation, did not show the same performance.

The data obtained indicate that the conditioner formulation can improve hair texture and decrease cortex porosity. The charge-charge interaction allows the adsorption or diffusion of the formulation ingredients into the hair.

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